

H.B

<b>Notice of Allowability</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/719,546	TAKEDA ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Thuy V. Tran	2821	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 11/21/2003.
2. ☒ The allowed claim(s) is/are 1-42.
3. ☒ The drawings filed on 21 November 2003 are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☒ All    b) ☐ Some\*    c) ☐ None    of the:
    1. ☒ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
  6. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
    - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
      - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
    - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

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| <ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)</li> <li>2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)</li> <li>3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),<br/>Paper No./Mail Date <u>2/23/2004</u></li> <li>4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br/>of Biological Material</li> </ol> | <ol style="list-style-type: none"> <li>5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)</li> <li>6. <input type="checkbox"/> Interview Summary (PTO-413),<br/>Paper No./Mail Date _____</li> <li>7. <input type="checkbox"/> Examiner's Amendment/Comment</li> <li>8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance</li> <li>9. <input type="checkbox"/> Other _____</li> </ol> |
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**THUY V. TRAN**  
**PRIMARY EXAMINER**

### **DETAILED ACTION**

This is a response to the Applicants' filing on 11/21/2003. In virtue of this filing, claims 1-42 are currently presented in the instant application.

#### ***Allowable Subject Matter***

1. Claims 1-42 are allowed.

#### ***Reasons for Allowance***

2. The following is an examiner's statement of reasons for allowance:

Prior art fails to disclose or fairly suggest:

- A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, a sum of the time ratios up to the n-th time ratio is set to be smaller than 0.5, and the time ratios up to the n-th time ratio are set so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 1 (claim 2 is allowed since it is dependent on claim 1);

- A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the time ratio is set to be smaller than 0.5, and so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 3 (claim 4 is allowed since it is dependent on claim 3);
- A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, a sum of the first time ratio and the second time ratio is set to be smaller than 0.5, and the first time ratio and the second time ratio are set so as to minimize a sum of ratios of values of respective

higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 5 (claim 6 is allowed since it is dependent on claim 5);

- A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, a sum of the time ratios up to the n-th time ratio is set to be smaller than 0.5, and the time ratios up to the n-th time ratio are set so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 7 (claim 8 is allowed since it is dependent on claim 7);
- A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, wherein the driving signal is a signal in a

rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the time ratio is set to be smaller than 0.5, and so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 9 (claim 10 is allowed since it is dependent on claim 9);

- A method for driving a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, a sum of the first time ratio and the second time ratio is set to be smaller than 0.5, and the first time ratio and the second time ratio are set so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 11 (claim 12 is allowed since it is dependent on claim 11);

- A driving circuit for a piezoelectric transformer comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and the control section sets a sum of the time ratios up to the n-th time ratio is set to be smaller than 0.5, and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 13 (claim 14 is allowed since it is dependent on claim 13);
- A driving circuit for a piezoelectric transformer comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, and a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section, wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum

potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the control section control a duty ratio or a phase of at least two control signals to be supplied to the switching elements, thereby setting the time ratio to be smaller than 0.5 and so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 15 (claim 16 is allowed since it is dependent on claim 15);

- A driving circuit for a piezoelectric transformer comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, and a driving section for supplying the driving signal to the piezoelectric transformer based on the control signal output from the control section, wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5, and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an

input current with a frequency that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 17 (claim 18 is allowed since it is dependent on claim 17);

- A driving circuit for a piezoelectric transformer comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and the control section sets a sum of the time ratios up to the n-th time ratio is set to be smaller than 0.5, and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 19 (claim 20 is allowed since it is dependent on claim 19);
- A driving circuit for a piezoelectric transformer comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are



formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the control section controls a duty ratio or a phase of at least two control signals to be supplied to the switching elements, thereby setting the time ratio to be smaller than 0.5 and so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 21 (claim 22 is allowed since it is dependent on claim 21);

- A driving circuit for driving a piezoelectric transformer comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode to a load, wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5, and sets the first time ratio and the second

time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, in combination with the remaining claimed limitations as called for in independent claim 23 (claim 24 is allowed since it is dependent on claim 23);

- A cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and the control section sets a sum of the time ratios up to the n-th time ratio to be smaller than 0.5 and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the n-th time ratio, in combination with the remaining claimed limitations as called for in independent claim 25;

- A cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the control section sets the time ratio to be smaller than 0.5 so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratio, in combination with the remaining claimed limitations as called for in independent claim 26;
- A cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained

by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios, in combination with the remaining claimed limitations as called for in independent claim 27;

- A cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and the control section sets a sum of the time ratios up to the n-th time ratio to be smaller than 0.5 and sets the time ratios up

to the n-th time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the n-th time ratio, in combination with the remaining claimed limitations as called for in independent claim 28;

- A cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the control section sets the time ratio to be smaller than 0.5 so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratio, in combination with the remaining claimed limitations as called for in independent claim 29;
- A cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is

converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios, in combination with the remaining claimed limitations as called for in independent claim 30;

- A liquid crystal panel including a cold-cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a

signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and the control section sets a sum of the time ratios up to the n-th time ratio to be smaller than 0.5 and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the n-th time ratio, in combination with the remaining claimed limitations as called for in independent claim 31;

- A liquid crystal panel including a cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the control section sets the time ratio to be smaller than 0.5 so as to minimize a sum of ratios of values of respective higher order

input currents with respect to a value of an input current of a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratio, in combination with the remaining claimed limitations as called for in independent claim 32;

- A liquid crystal panel including a cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios, in



combination with the remaining claimed limitations as called for in independent claim 33;

- A liquid crystal panel including a cold-cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th (n is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and the control section sets a sum of the time ratios up to the n-th time ratio to be smaller than 0.5 and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the n-th time ratio, in combination with the remaining claimed limitations as called for in independent claim 34;
- A liquid crystal panel including a cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a

secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the control section sets the time ratio to be smaller than 0.5 so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratio, in combination with the remaining claimed limitations as called for in independent claim 35;

- A liquid crystal panel including a cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the

driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios, in combination with the remaining claimed limitations as called for in independent claim 36;

- A device with a built-in liquid crystal panel including a cold-cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having time periods up to an n-th ( $n$  is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an n-th time ratio, and the control section sets a sum of the time ratios up to the n-th time

ratio to be smaller than 0.5 and sets the time ratios up to the n-th time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the n-th time ratio, in combination with the remaining claimed limitations as called for in independent claim 37;

- A device with a built-in liquid crystal panel including a cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the control section sets the time ratio to be smaller than 0.5 so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current of a frequency that excites the piezoelectric transformer, and generates the control signal based on the set time ratio, in combination with the remaining claimed limitations as called for in independent claim 38;

- A device with a built-in liquid crystal panel including a cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of ratios of values of respective higher order input currents with respect to a value of an input current with a frequency that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios, in combination with the remaining claimed limitations as called for in independent claim 39;
- A device with a built-in liquid crystal panel including a cold-cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a

driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having time periods up to an  $n$ -th ( $n$  is a natural number of 1 or more) time period in which a level is varied successively from a maximum potential and a minimum potential to an intermediate potential, obtained by respectively multiplying a period of the driving signal by time ratios up to an  $n$ -th time ratio, and the control section sets a sum of the time ratios up to the  $n$ -th time ratio to be smaller than 0.5 and sets the time ratios up to the  $n$ -th time ratio so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratios up to the  $n$ -th time ratio, in combination with the remaining claimed limitations as called for in independent claim 40;

- A device with a built-in liquid crystal panel including a cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving

signal is a signal in a rectangular waveform having a time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a predetermined time ratio, and the control section sets the time ratio to be smaller than 0.5 so as to minimize a sum of ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set time ratio, in combination with the remaining claimed limitations as called for in independent claim 41; and

- A device with a built-in liquid crystal panel including a cold cathode tube light-emitting apparatus comprising a piezoelectric transformer in which a primary side electrode and a secondary side electrode are formed in a piezoelectric body, and a driving signal input from the primary side electrode is converted and output from the secondary side electrode, and a control section for generating a control signal for controlling a driving frequency and input power of the piezoelectric transformer based on the detection signal output from the detection section, wherein the driving signal is a signal in a rectangular waveform having a first time period in which a level is a maximum potential or a minimum potential, obtained by multiplying a period of the driving signal by a first time ratio and a second time period in which a level is a potential between the maximum potential and the minimum potential, obtained by multiplying a period of the driving signal by a second time ratio, and the control section sets a sum of the first time ratio and the second time ratio to be smaller than 0.5 and sets the first time ratio and the second time ratio so as to minimize a sum of

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ratios of amplitudes of respective higher order vibration modes with respect to an amplitude of a vibration mode that excites the piezoelectric transformer, and generates the control signal based on the set first and second time ratios, in combination with the remaining claimed limitations as called for in independent claim 42.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

***Citation of relevant prior art***

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Prior art Toshinari et al. (U.S. Patent No. 6,226,196) discloses a piezoelectric transformer inverter.

Prior art Noma et al. (U.S. Patent No. 6,184,631) discloses a piezoelectric transformer inverter.

Prior art Noma et al. (U.S. Patent No. 6,153,962) discloses a piezoelectric transformer inverter.

Prior art Kumasaka et al. (U.S. Patent No. 6,118,221) discloses a cold-cathode tube lighting circuit for piezoelectric transformer.

Prior art Kawasaki et al. (U.S. Patent No. 6,028,398) discloses a cold-cathode fluorescent lamp driving apparatus using a piezoelectric transformer inverter.



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Prior art Furuhashi et al. (U.S. Patent No. 5,942,835) discloses a piezoelectric transformer drive circuit.

Prior art Shimada et al. (U.S. Patent No. 5,923,546) discloses a control circuit and method for driving a piezoelectric transformer inverter.

Prior art Honbo et al. (U.S. Patent No. 5,886,477) discloses a driver of cold cathode fluorescent lamp using a piezoelectric transformer.

Prior art Shimada et al. (U.S. Patent No. 5,886,969) discloses a driving circuit and method for a piezoelectric transformer inverter.

Prior art Shimada (U.S. Patent No. 5,859,489) discloses a piezoelectric transformer driving circuit.

Prior art Shimada (U.S. Patent No. 5,705,877) discloses a piezoelectric transformer driving circuit.

Prior art Shimada (U.S. Patent No. 5,675,484) discloses a piezoelectric transformer inverter.

### ***Inquiry***

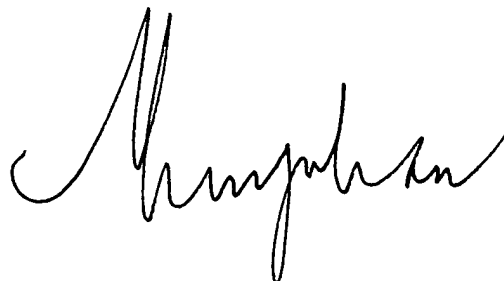
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thuy V. Tran whose telephone number is (571) 272-1828. The examiner can normally be reached on M-F (8:00 AM -5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Don Wong can be reached on (571) 272-1834. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

03/05/2005

A handwritten signature in black ink, appearing to read 'Thuy V. Tran', is positioned above the printed name and title.

**THUY V. TRAN**  
**PRIMARY EXAMINER**